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GASTRIC ULCER AT THE MASSACHUSETTS GENERAL HOSPITAL, 1888–1898.[1]

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In connection with an article by Dr. J. Collins Warren on "The Surgery of Gastric Ulcer, with the Report of a Case of Gastrolysis,"[2] the writers undertook a study of the cases of this disease which were operated upon at the Massachusetts General Hospital for the ten years 1888–1898. To supplement this investigation Dr. Warren obtained permission to make use of the medical records. It was hoped by this means to bring out the possibility and often the advisability of an operation in a much larger number of cases of ulcer. This proved to be the case, and the subject was discussed by Dr. Warren in his paper. The records, however, afforded so good an opportunity for a collection of statistics that it was suggested that a report be made on the whole subject of gastric ulcer for this period. This we have attempted to do with the help and under the direction of Dr. Warren and your President, Dr. Fitz.

The great mass of statistics on the subject of gastric ulcer is based on the results of post-mortem examinations, and is chiefly of a pathological nature. Little can be added to what Dr. Welch[3] wrote on this subject in 1885 for Pepper's *System of Medicine;* but, as only a small portion of those afflicted with this disease die during its course, it is obvious that statistics bearing on the clinical course of gastric ulcer are especially to be desired. Recently Leube[4] reported 556 cases which came under his own observation, but no such exhaustive collection has been attempted as that by Welch on the pathological side. The subsequent condition of such patients has been still less studied, and along this line there is little positive knowledge. It is with this subject—the after-history of these cases—that the present paper is chiefly concerned, since knowledge as to the results of treatment have been obtained in 114 of the 187 cases which occurred during the decade.

In the ten years 1888–1898 there entered the hospital 187 cases of

[1] Read in part before the Boston Society for Medical Improvement, April 10, 1899.

[2] Read before the Boston Society for Medical Improvement, May 16, 1898. Boston Med. and Surg. Journ., vol. cxxxix. p. 308.

[3] Welch. Pepper's System of Medicine, 1885, vol. ii. p. 480.

[4] Leube. Beitrage Centralbl. für Chir., 1897, No. 28, p. 66.

gastric ulcer. These patients were about equally divided between the two hospital medical services, and this fact affords an opportunity for studying the disease under somewhat different conditions. The total number of medical patients who entered the hospital during this time was 13,097, which gives us the percentage of gastric ulcer to the total number of patients as 1.4 per cent. This result is in striking harmony with the conclusion Welch[1] draws for Europe—namely, that there are open ulcers present in 1 to 2 per cent. of persons dying from all causes. In his 32,052 autopsies, however, about 5 per cent. showed cicatrized or open ulcers, the scars being about two and one-quarter times as frequent as the open ulcer. In Lebert's[2] clinical material of 41,688 cases seen in Zurich and Breslau there were 252 cases, or only 0.64 per cent., of ulcers of the stomach.

Geographical Distribution. It is a well-known fact that the disease is more frequent in some localities than in others. Thus Berthold[3] (his and the following statistics being based on autopsies) gives 2.7 per cent. for Berlin; Nolte,[4] 1.23 per cent. for Munich; Gneiss,[5] 8.3 per cent. for Kiel and 10 per cent. for Jena, and Starck,[6] 13 per cent. for Copenhagen. We have been able to determine the comparative frequency of gastric ulcer in Baltimore, Chicago, Denver, and Boston through the kindness of Dr. Capps, of Chicago University; Drs. McCrea and Cushing, of the Johns Hopkins Hospital, and Dr. Hobart E. Warren, of Denver University. These facts are shown in the following table:

	Medical admissions.	*Diagnosis of gastric ulcer.*
Massachusetts General Hospital, Boston	13,097	187, or 1.43 per cent..
Johns Hopkins Hospital, Baltimore	9,517	30, or 0.32 "
Cook County Hospital, Chicago	3,930	6, or 0.15 "
Arapahoe County Hospital, Denver	5,040	6, or 0.12 "

Welch claims that in general the disease is more common in northern than in southern countries, and this statement is partially confirmed by the preceding data.

v. Sohlern[7] found that ulcer was comparatively rare in a part of Russia, in the Roen Mountains, and the Bavarian Alps of Germany. He attributes this immunity to the greater amount of potassium salts in the water of those localities. A similar investigation would be of interest in this country, but it is beyond the scope of this paper.

Sex. Sex has played a prominent rôle in the minds of all in the etiology of gastric ulcer. Thus Welch found in 1699 cases that 40 per cent. were male and 60 per cent. females. Brinton[8] puts the average higher—

[1] Welch. Loc. cit.
[2] Lebert. Quoted by Welch, loc. cit.
[3] Berthold. Loc. cit. Ewald, Krank. des Magens., p. 382.
[4] Nolte. Loc. cit. Ewald, Krank. des Magens., p. 382.
[5] Gneiss. Loc. cit. Ewald, Krank. des Magens., p. 382.
[6] Starck. Loc. cit. Ewald, Krank. des Magens., p. 382.
[7] v. Sohlern. Der Einfluss der Ernährung auf die Entstehung des Magengeschwürs. Berl. klin. Wochen., 1889, No. 13.
[8] Brinton. Fleiner, Krankheiten der Verdauungsorgane, p. 266.

i. e., two to one—and Willigh[1] goes further yet and makes the proportion three to one. Fiedler[2] examined 2200 bodies with reference to ulcer or ulcer scars, and found 20 per cent. women to 1.5 per cent. men, which gives the proportion as fourteen to one, the highest we have found stated. With this exception the susceptibility of females to gastric ulcer compared with that of males appears far higher in Boston than elsewhere. One hundred and fifty-seven of the cases at the hospital were females and only thirty males, thus making the proportion five to one. No such disproportion exists in the total number of males and females admitted to the hospital. Indeed, the number of male admissions usually exceeds that of the female. The explanation of this great preponderance of ulcer cases in females in Boston we must leave unanswered. In the hospital, at any rate, gastric ulcer among men is a rare disease, there being but one case to 436 admitted, this being about the number of patients occurring in a single six months' service.

The importance of sex in etiology has been recognized from the earliest days, and Schröder[3] and Kuttner[4] in the last decade have called attention to gastric hemorrhage occurring at the time of the menstrual flow, especially in ulcer patients, where the mucous membrane is obviously more sensitive. Bearing this in mind, we searched the records for cases which should show some connection between the vomiting of blood and the menstruation. In two cases the first vomiting of blood took place at the catamenia, and in two others amenorrhœa was coincident with the beginning of symptoms. There was nothing else recorded of sufficient definiteness or note to warrant mention.

Age. The age of the patients closely corresponds to what has already been written on the subject. There was no case exceptionally young or old, the two extremes being eight and sixty-seven years respectively. The ages of patients at autopsy give an incorrect idea in this regard, and, therefore, we quote Lebert's[5] statistics instead of those of Welch for comparison :

Years	5–10	10–20	20–30	30–40	40–50	50–60	60–70
Lebert	1	24	87	84	34	17	5
	9.92 per ct.		67.86 per ct.		20.24 per ct.		1.99 per ct.
Massachusetts Gen. Hosp.	1	22	109	33	13	8	1
	12.29 per ct.		75.95 per ct.		11.23 per ct.		0.53 per ct.

The average age of the male patients was 36.75 years and that of the female 27.1 years. Eleven of the male patients were under the age of thirty, and 113 of the female. This corresponds with the statistics

[1] Willigh. Fleiner, p. 266.

[2] Fiedler. Sitzungsber. des Dresdener Vereins f. Natur u. Heilkunde, 1883, cited by Ewald Krank. des Magens., p. 383.

[3] Schröder. Die Chirurgie des Magens, Schröder, Lindner, Kuttner. Loc. cit., p. 131.

[4] Kuttner. Loc. cit.

[5] Lebert. Welch, in Pepper's System of Medicine.

given by Welch. Gastric ulcer thus is most common in women between the ages of twenty and thirty, and in men a decade later.

Trauma. Trauma was ascribed as the cause of the ulcer in some of our cases, but not with sufficient clearness to merit discussion.

Occupation. So much has been written of the prevalence of gastric ulcer among servant girls and cooks that we examined the records with especial reference to this point. Realizing that these classes of society are in predominance among the hospital patients, we have also calculated out the relative per cent. in which they stand to some two hundred consecutive female admissions. This is shown in the following table:

Occupation.	157 *female ulcer patients.*	216 *consecutive female admissions.*
Housework	66 per cent.	71 per cent.
Cooks	7 "	4 "
Dressmakers	11 "	8 "
Nurses and nursery maids	5 "	6 "

Though the cooks figure rather more prominently in the ulcer column than in that of the general admissions, they in reality play a very subordinate rôle in the total number of patients. Of the male patients there was but one tailor and three shoemakers, and only two of the remaining number worked in an especially warm environment. Occupation, then, so far as our statistics go, plays a very insignificant part in the causation of ulcer.

Symptoms. There has been a growing tendency in the last few years to put the symptomatology of gastric ulcer on a firmer basis. Fitz and especially Fleiner have brought this out in their books. Disturbances of secretion and motility are facts, whereas pain and vomiting are but symptoms. Following out this idea, Fleiner has the following arrangement in his symptomatology of ulcer:

In the first place is the disturbance of secretion of the stomach, which writers now pretty generally recognize as the true basis of the other symptoms. Then comes pain, and then the disturbed motor function, including "peristaltic unrest," antiperistalsis, and vomiting under this head. The fourth symptom is hæmatemesis. In our opinion he is right in thus throwing emphasis on the disturbance of gastric secretion in ulcer. Though a stomach tube can be seldom passed, a few properly directed questions can throw much light on the activity of the stomach's secreting cells and its muscular fibres. It is in this way that we may hope to make progress in diagnosis. The order of frequency of the chief symptoms occurring in the hospital patients was as follows:

Frequency of symptoms.	*Total number of patients,* 187.
Vomiting	179 cases, or 95.7 per cent.
Pain	173 " 92.5 "
Vomiting of blood	147 " 78.6 "
Pallor	131 " 70.1 "
Tenderness	130 " 69.5 "
Constipation	123 " 65.8 "

Vomiting was the symptom most uniformly present, being absent in but four patients, and with the matter left doubtful in four others. The time of vomiting was so variable in the different patients, and in fact in the same individual, that little of value could be gleaned from the records in this regard. This is unfortunate, because the statements of authors diverge so widely on this point. Ewald[1] and Leube[2] say the vomiting occurs soon after eating. Boas[3] puts it at the height of the paroxysm of pain, and Osler[4] "not for two or more hours after eating." Hemmeter does not commit himself. Thus these conflicting statements show that the time of vomiting is not a factor in diagnosis. The quantity of the vomitus is also indefinite, for one must take statements of the amount of vomitus with caution. This symptom will be further discussed under hemorrhage.

Pain. The pain was definitely located in practically all the cases, though not always confined to one special area. Thus pain was felt in the epigastrium in 144 of the 173 cases in which pain occurred as a symptom, but in only ninety-one of this number was it wholly confined to this locality. How varied was its distribution can be seen from the following table:

Situation of pain.

Epigastrium		91
"	and back	23
"	back and chest	2
"	" right costal border	1
"	" left hypochondrium	5
"	" right hypochondrium	2
"	and left hypochondrium	8
"	and chest	4
"	and between shoulders	2
"	and left shoulder blade	3
"	and umbilicus	1—51
	Total epigastrium and elsewhere	142

Various writers have called attention to the situation of the pain in regions not adjacent to the stomach, and the significance of this fact has not been by any means over-estimated, as our table shows. In differential diagnoses between gastric ulcer and gallstones too much dependence must not be put on the symptoms of pain in the right shoulder, for, as Brinton[5] has pointed out, pain may be situated there in ulcer. In a case of perforation of an ulcer into the lesser peritoneal cavity, recently seen by one of the writers of this article, the pain was felt at the top of both shoulders.

Attention has been called to pain in the back in gastric ulcer, and the importance of the pain elicited on pressure in this region has been insisted upon by Boas[6] as a valuable diagnostic sign. He goes so far as to say that dorsal pain on pressure is, in his experience, present in

[1] Ewald. Loc. cit., p. 398.
[2] Leube. Specielle Diagnose, I., p. 260.
[3] Boas. Spec. Diag. und Therap. der Magenkrank., II., 36.
[4] Osler. Loc. cit., p. 481.
[5] Brinton. Quoted by Fleiner, p. 272.
[6] Boas. Spec. Diag. und Therap. der Magenkrankheiten, p. 38

one-third of all ulcer cases. Though we are dealing with pain as described by the patient, and not with tenderness, the following table may be inserted as to a certain extent carrying out his view. Dorsal "druckschmerz" was not sought for with sufficient uniformity to be recorded, but this table would lead us to suppose that it often existed, on account of the many cases with pain in the back:

Situation of pain.

Back		1
" and epigastrium	23	
" epigastrium and chest	2	
" and chest	1	
" epigastrium and right costal border	1	
Between shoulders and epigastrium	2	
Back, epigastrium, and left hypochondrium	5	
" " and right hypochondrium	2	
" right hypochondrium and right shoulder	1	
Left shoulder blade and epigastrium	3	—40
Total back and elsewhere		41

In one case the pain was felt only in the back, but otherwise the symptoms presented nothing peculiar. This patient vomited blood, and blood was present in the stools, though there was no severe hemorrhage. She was fed by the rectum exclusively for six days following her admission, and we learn that since leaving the institution she has had a recurrence of the disease.

It is reassuring to note how few times pain occurred to the right of the median line. Six instances only of this sort came to our attention.

It is worthy of note that only three patients spoke of their pain as occurring before meals, and that only about the same number were relieved by food. As ulcer patients have a hypersecretion of the gastric juice, as a rule, we should expect this symptom to be more frequent. It may be accounted for, perhaps, in this way, that in comparison with the severity of the pain after meals that present before dropped out of mind. The pain followed the ingestion of food in 102 individuals. It was unrelated to meals in nineteen cases. In eighteen persons the pain was continuous. Usually the pain was relieved by vomiting, and several times it was lessened by pressure. Here, again, opinions differ. Osler[1] writes: "Pressure is, as a rule, grateful." Leube:[2] "By external pressure it (pain) is generally increased, very seldom relieved," while Dr. Fitz[3] agrees with both by saying: "Pressure sometimes aggravates, at other times lessens, the pain."

Pain was not felt at all in fourteen of the 187 patients, and the character of the disease in these cases is instructive. In 50 per cent. of this number the onset of the ulcer was with hemorrhage of a severe type, and three of these seven cases died, thereby, as will be seen later, constituting nearly one-half of all the fatal cases of hemorrhage. Five

[1] Osler. Practice of Medicine, 1898, p. 482.
[2] Leube. Loc. cit., p. 260.
[3] Fitz. Wood and Fitz, loc. cit., p. 838.

others also had marked hemorrhages, while the diagnosis of the disease was somewhat doubtful in the two remaining patients. Thus it appears that those cases of ulcer of the stomach in which there is no pain represent, as a rule, a grave type of the disease.

Hemorrhage. Hemorrhage is considered by Osler,[1] Hemmeter,[2] and others as present in about 50 per cent. of all cases of gastric ulcer. Leube[3] met with this symptom in 46 per cent. of 556 cases. The term hemorrhage is so broad that we have divided our cases into two groups. In the first are classed all cases which vomited blood, no matter what the amount. This is the hemorrhage class of the books. In our second group we put those cases in which the loss of blood was so appreciable as to cause symptoms directly attributable to this loss. In many cases the blood-count helped in the classification.

One hundred and forty-seven of the 182 patients in which the records are available vomited blood either during their stay in the hospital or immediately preceding entrance. This gives the hospital percentage for hemorrhage as 81 per cent. This is certainly a striking difference from the usually accepted data. Possibly in the statistics of others cases from the polyclinic were made to figure, and, if so, that would account for the unusual severity of the disease at the hospital.

Eighty-six cases form our second group, and constitute the number in which the loss of blood was productive of constitutional symptoms. Thus 45 per cent. of the cases had one or more severe hemorrhages.

Hemorrhage ushered in the symptoms of ulcer nineteen times—in fifteen instances in females and in four in males. This bore no relation to the age of the individual, for the youngest of these patients was a woman, aged twenty years, and the oldest a man, aged fifty-three years, while the average age of these nineteen male and female patients, 38.2 and 28.9 years, respectively, closely corresponds to that which obtains for the whole number of patients. Fleiner discusses this question of hemorrhage as the first symptom of ulcer of the stomach, and it is to be conceded, as he says, that usually the ulcer is present long before the hemorrhage. It is possible, however, for a sudden occlusion of an artery to take place, a necrosis and autodigestion to follow, and the vessel or a neighboring one to be thus opened up, as Schell[4] recently reported.

The hemorrhage was fatal in seven cases, or 3.7 per cent., and in three of this number it was the first symptom. The fatality as regards sex is striking, as five of the thirty male patients, or 17 per cent., died from hemorrhage alone, while only two of the 157 females, or 1.27 per cent., died from this cause. (Note.—It is but fair to say that in two of the fatal cases of hemorrhage in males there was no autopsy.) It

[1] Osler. Practice of Medicine, 1898, p. 481.
[2] Hemmeter. Diseases of the Stomach, 1897, p. 476. [3] Leube. Loc. cit.
[4] Schell. Review in Arch. f. Verdauungskrank, 1898, p. 390.

would thus seem that women can lose blood with greater impunity than men, and this is easy of belief.

The ages of the five male patients who died of hemorrhage were twenty-five, forty-seven, fifty-two, fifty-seven, and sixty, giving an average of forty-eight years to contrast with 36.75 years, the average of all male patients. The ages of the two female patients so dying were thirty-six and forty-nine, giving an average of 42.5 years to contrast with 27.1, the average age of the whole number of females.

These facts indicate in no uncertain way that the younger the individual the less probability of death from hemorrhage in gastric ulcer. Whether this is wholly due to the better recuperative power of youth or to changes in the arteries or blood remains to be seen.

Hood,[1] some years ago, called attention to the rarity of fatal cases of hemorrhage in gastric ulcer in females under thirty. In the years 1870–1890 at Guy's Hospital, London, there were sixty-six cases of hemorrhage due to gastric ulcer; and though there were twenty-nine of this number (twenty-seven females, two males) under thirty, but one case proved fatal, and that a male. Referring to these statistics, he writes: "They . . . bring out the striking fact that during a period of twenty years at one of our largest London hospitals there has been no recorded case of fatal hemorrhage occurring in the person of a young female the subject of gastric ulcer." The same statement can be made of the Massachusetts General Hospital for the ten years 1888–1898. Perforation, on the other hand, is not limited to age or sex. Hood, therefore, suggests that hemorrhages from the stomach in anæmic young women are often not due to ulcer, and that in general the symptom receives too much attention in the diagnosis of this disease. At any rate, the above statistics allow us to agree with Hood, "That hemorrhage from the stomach in early adult female life is usually not a symptom of great gravity."

It had been our opinion, as gathered from the books, that it was not the violent hemorrhage which killed but rather the sum of repeated hemorrhages or a constant oozing from the bloodvessels. This opinion was evidently well founded, for in five of the seven fatal cases the hemorrhages were recurrent and extended over a considerable period of time, while in two only did the patients die soon after the hemorrhage, and then only in three and nine days, respectively. It is of interest to add that in these two cases hemorrhage was the first symptom, and one patient had no pain at all except for a few hours, and no especial tenderness. Gastric hemorrhage, therefore, kills by the subsequent exhaustion it entails rather than by the immediate loss of blood.

Operation was performed twice for hemorrhage, but hardly other than an untoward result could have been expected, because it is recorded

[1] Hood. The Medical Society's Transactions, London, vol. xv. p. 283.

of one patient before the operation, "pulse at times cannot be felt," and in the other case the surgical procedure was considered only a forlorn hope. No one hesitates at the present time to call the surgeon early for consultation in appendicitis. In typhoid fever, where perforation threatens, this is also common; in severe cases of gastric ulcer a consultation should be the rule.

The presence or absence of blood in the stools is too difficult a problem to be left to the patient to decide. Hosslin[1] says that a hemorrhage arising in the stomach only gives the stools the characteristic tea color when it amounts to 500 c.c. As probably but few of our gastric hemorrhages reach this amount, it is obvious how many times blood must be lost unnoticed. A microscopical examination, on the other hand, unless in the hands of experts, may only serve to give a wrong idea in the matter, since crystals of sulphide of bismuth to closely resemble hæmin crystals as to be easily mistaken for them. With these considerations in mind it is rather surprising that blood is recorded present in the stools fifty-five times. But that such data are unreliable is evident when we consider that probably most of the patients were taking bismuth and many iron at the time of the observation.

Pallor. Pallor was observed in 131 of the 164 patients in which a record of this condition was made, and was thus absent in only 20 per cent. of these cases. It is only within the latter half of the present decade that routine examinations of the blood have been made in all cases at the Massachusetts General Hospital, and our data upon this point represent only a limited number of cases. The hæmoglobin was estimated in seventy-three cases, of which thirty-four were below 50 per cent. and sixty-four below 80 per cent. This is about the proportion of cases in which pallor was noted to be present, and would establish the fact that about 80 to 85 per cent. of ulcer cases show a diminution of hæmoglobin, which accords with the view of other observers—Cabot,[2] v. Limbeck.[3] The red corpuscles were counted in forty-three cases, and in only twenty-four, or about one-half, were below four millions. This suggests a greater diminution of hæmoglobin than of corpuscles in the majority of cases, and this ratio is expressed by the "color index" of writers on the blood. The color index is the per cent. of hæmoglobin divided by the per cent. of corpuscles, and is calculated on the basis of 5,000,000 red corpuscles and 100 per cent. hæmoglobin to the normal blood. The color index in forty-three cases gave an average of 0.67, the highest being 1.41 and the lowest 0.35. In other words, as Silbermann,[4] Cabot,[5] Leube,[6] and others have pointed out, an anæmia of the chlorotic type is the rule.

[1] Hosslin. Münch. med. Wochensch., 1890, No. 14.
[2] Cabot. Clin. Exam. of Blood. Wm. Wood & Co., 1897.
[3] v. Limbeck. Grundriss einer klinischen Pathologie des Blutes, June, 1896.
[4] Silbermann. Zur Lehre von Ulcus Ventriculi rotundum. Deut. med. Woch., No. 29, 1886.
[5] Cabot. Loc. cit.
[6] Leube. Specielle Diagnose.

The interest in this fact lies in the etiological significance of a reduced alkalinity of the blood, such as occurs in chlorotic anæmia (Silbermann, Pavy,[1] Leube), and our statistics may be considered at least suggestive in this connection four cases of the series showed indices above one. These were all young females with severe, sudden, but not fatal hemorrhages, and we are at a loss to explain the phenomenon. Cabot[2] states that "A color index above one is not met with except in pernicious anæmia." Osterspey[3] reports two cases with index above one (3,296,000 reds and 70 per cent. hæmoglobin = 1.06, and 4,048,000 reds with hæmoglobin 84 = 1.05). One of these cases was a young girl, aged eighteen years, with hemorrhage; the other a man, aged forty-eight. Cabot himself mentions one similar case, but attributes it to a mistake.

The average color index in six males was 0.64, and in thirty-seven females 0.68; no marked difference can be noted with regard to sex.

Five of our cases showed one peculiar feature in that the hæmoglobin appeared to diminish during the first few days in the hospital without corresponding loss of corpuscles or recognized hemorrhage. This diminution of from 5 to 15 per cent. continued for from seven to ten days, and was then followed by slow recovery. The explanation may perhaps be that the dilution of the blood and formation of new corpuscles proceed more rapidly than the manufacture of new hæmoglobin.

The subjoined table will indicate the general character of the blood examinations:

Hæmoglobin, 73 cases.

20 to 30 per cent.	7	70 to 80 per cent.	8
30 " 40 "	10	80 " 90 "	5
40 " 50 "	17	90 " 100 "	3
50 " 60 "	15	100+ "	1
60 " 70 "	7		73

Red Corpuscles, 43 cases.

1 to 2 millions	6	5 to 6 millions	10
2 " 3 "	7	6 " 7 "	0
3 " 4 "	11	7 " 8 "	2
4 " 5 "	7		43

Tenderness. Tenderness has perhaps led to as many wrong diagnoses of ulcer as any one symptom. This sign has been too often elicited by leading questions on the physician's part. The Boas æsthesiometer contributed to the undue emphasis put upon it. This may partly account for the reaction which has already set in, and it is with great satisfaction to us that in the last edition of Osler that writer gives still less prominence to the subject than in his earlier edition. The symptom is most indefinite, in our opinion, and should have a small share in diagnosis. Of the 187 patients, 130 showed more or less tenderness, but the records made evident that fifty-one patients were distinctly not tender,

[1] Pavy. Pepper's System of Medicine. [2] Loc. cit.
[3] Osterspey. Die Blutuntersuchungen und deren Bedeutung bei Magenkrank., Berlin, 1892.

and the matter was left in doubt six times. That tenderness was absent fifty-one times is especially suggestive, because the patients were cases in which the course of the ulcer was a severe one and the period of observation long. Hysterical symptoms are so common in chlorotic girls that the wonder is that more of them did not agree to a sensitiveness on pressure in the abdomen.

Constipation. It is not surprising that constipation occurred in 123 of the 152 cases in which notes on this matter were made, because for the most part the patients were women, and of a class of society apt to pay little attention to the rules of health.

Perforation. Perforation occurred in six, or 3.2 per cent., of the total number of cases. Four of the cases were in females, or 3.2 per cent., of the whole number of female patients. One was a male, giving 3.3 per cent. as the frequency of perforation among men. Thus no such difference exists in the sexes in perforation as does liability to a fatal hemorrhage. Age appears to have little to do with the matter, as the females were eighteen, twenty-two, thirty, forty-one, and fifty-seven, and the one male patient was twenty-six. No perforation occurred without previous symptoms of ulcer, though in the case of a cook, aged forty-one years, there had been only very slight dyspeptic trouble for one month. In the other patients symptoms of ulcer had been present for periods varying from a few months to two and one-half years, and the complication plainly took place in an old ulcer. As a rule, when the perforation occurred it came on suddenly and left little doubt as to what had happened. All of the patients with perforation died, but one of these, a woman, aged thirty years, lived seventy days, and the autopsy revealed a parenchymatous nephritis as the direct cause of death and as coexistent a fibrinous perigastritis. This patient, in the two and one-half years preceding her entrance to the hospital, had had three attacks of hemorrhage, and whether this, as has recently been suggested, was contributory to her nephritis is a question. Certain it is, however, that on June 9, 1889, the date of the perforation, her urine was normal, but on August 18th of the same year it contained casts. On this day she had convulsions and died. For this reason in our mortality table her death is entered as perforation and parenchymatous nephritis.

The study of the perforation cases is chiefly of interest from a surgical point of view, and it has seemed worth while to tabulate these six cases for convenience:

Case.	Days between perforation and death.	Diet at time of perforation.	Operation.	Situation of perforating ulcer.	Autopsy and result.	Remarks.
E. 3	3	House diet at Convalescent Home.	Not advised by surgeon, patient moribund.	Lesser curve and posterior wall.	General peritonitis.	Convalescing at Waverly. Tonsillitis; perforation.
E. 28	15	Home. ?	Refused 24 hours after perforation.	Anterior wall.	Local abscess.	
E. 18	70	Starvation for 14 days before in M. G. H.	Not advised by surgeon.	Lesser curve.	Adhesions; no pus.	Died of nephritis.
E. 40	3	Milk in M. G. H.	0	?	No autopsy.	
W. 72	7	Liquids in M. G. H.	Six hours after perforation.	Lesser curve, anterior.	General peritonitis; no autopsy.	
W. 77	? No diag. in life.	Never starved.	0	Lesser curve, anterior.	Local abscess.	Not recognized in life as ulcer.

The situation of the ulcer is found to have been upon the lesser curvature in four cases, of which two perforated anteriorly and one posteriorly. In one case the ulcer was on the anterior wall, and in one the situation was not known. The statistics of Welch[1] are of interest in this connection, and would seem to justify the frequency of the lesser curvature as the seat of the ulcer in our cases:

Welch. 788 cases.

Lesser curvature	283	36 per cent.
Posterior wall	235	29 "
Pylorus	95	12 "
Anterior wall	69	8 "
Cardia	50	6 "
Fundus	29	3.7 "
Greater curvature	27	3.4 "
	788	

The situation of the ulcer is of especial interest to the surgeon, on account of the varying results of perforation. In our six cases general peritonitis resulted twice, and in both instances the ulcer was situated on the lesser curvature, one anteriorly and one posteriorly. In two cases local abscess resulted, one where the ulcer was on the anterior wall and one where it was on the lesser curvature and perforated anteriorly. Perigastritis prevented any untoward results in one case, and in the last patient no autopsy was obtained. These facts are suggestive in that they show that the perforation into the general abdominal cavity is not the most likely result, but that adhesions may bar the spread of infection even in cases of ulcer of the anterior wall; and that in all probability the mobility of the stomach and its freedom from adhesions

[1] Welch. Pepper's System of Medicine.

are the factors most important in determining the immediate results of perforation.

Another fact to be noted in our cases is that only one of them suffered perforation of the ulcer when on starvation diet, and that this one alone survived the perforation and died later of nephritis, with only a fibrinous perigastritis to mark the site of the ulcer. An operation was performed upon one case six hours after the perforation, but as the patient had been taking large quantities of liquids (℥viij. ev. 2°), a fatal result was not unexpected. In the other five cases an operation was once refused by the patient and twice by the surgeon. In one case the record is deficient, and in the last the disease was not recognized during life.

Results. Welch,[1] in his oft-quoted article, gives 85 as the percentage of cures in gastric ulcer. Leube,[2] in 1897, recorded 74 per cent. cured of 556 patients treated by himself. Ewald[3] gives 75 per cent. in an analysis of 123 hospital patients, but Debove and Remond,[4] from a study of one hundred patients, show only 50 per cent. complete cures. As to mortality, the figures vary between 50 per cent. (Debove and Remond) and 2 per cent. (Leube).

With these data in mind we have worked up the hospital statistics in two ways: In the first place, classifying the condition of the patients as stated in the records at the time of their discharge, and in the second place according to their state of health at the present time. We have interviewed personally or by letter the patients, their friends or employers, doctors, postmasters, city and town officials.[5] To all of these we would express our gratitude and appreciation that through them we have been able to report on 114 cases. For the sake of comparison we insert the report of the condition at discharge of 187 cases of gastric ulcer—the total number—treated at the Massachusetts General Hospital between 1888–1898:

[1] Welch. Loc. cit. [2] Leube. Loc. cit.

[3] Ewald. See Lindner-Kuttner, p. 113.

[4] Debove and Remond. Cit nach Mikulicz die chirurgische Behandlung des chron. Magenschwurs. Mitteilungen aus de Grenzgeb. des Med. u. Chirurgio, 1897, Bd. ii. p. 188.

[5] The following letter was sent out:

Boston, Mass., May 6, 1898.

Dear .....

Wishing to obtain some statistics regarding the disease from which you suffered, with a view to furthering our knowledge of this affection, I take the liberty of asking you to favor me with answers to the following questions:

1. Has your health been good since leaving the hospital? Answer.
2. Have you had any pain in the region of the stomach? Answer.
3. Have you vomited? Answer.
   a. If so, how many pints at one time? Answer.
   b. Was there any blood in the material vomited? Answer.
4. Have you been constipated? Answer.
5. Have you gained or lost weight, and how many pounds? Answer.
6. Have you had eructations of gas or any other marked symptoms of dyspepsia? Answer.

A return of this paper with the desired answers in the inclosed envelope before May 12th, will greatly oblige,

Yours respectfully,

Massachusetts General Hospital. J. Collins Warren, M.D.

Cured	121	64 per cent.
Relieved	34	18 "
Deaths	15	8 "
Otherwise	17	9 "

Report of the condition at discharge of 114 cases of gastric ulcer in which the subsequent condition could be determined:

At discharge		*At an average of five years later.*			
		Recurrence.	*Dead.*	*Cured.*	*Total.*
63 Cured	55 per cent.	28	8	27	63
29 Relieved	25 "	10	4	15	29
15 Deaths	13 "	...	...	...	...
7 Otherwise	6 "	3	3	1	7
114		41	15	43	99

Of the fifteen patients who died after leaving the hospital the cause was known to be gastric in eight, non-gastric in three, and doubtful in four. Revising the latter half of the last table with these facts in mind we have:

Table showing mortality and condition of 114 patients of gastric ulcer at an average period of five years after entrance to the hospital:

Cured 43 + 3	46	40 per cent.
Not cured—recurrence	41	36 "
deaths 15 + 8	23	20 "
deaths, cause unknown	4	4 "
	114	

The cause of death in the twenty-three instances in which it was related to the ulcer can be summarized as follows:

	Males.	*Females.*	*Total.*	*Per cent.*
Deaths in the hospital—				
Hemorrhage	5	2	7	3.7
Perforation	1	4	5	2.7
Perforation and parenchymatous nephritis	0	1	1	0.5
Exploratory laparotomy	1	0	1	0.5
Cancer[1]	1	0	1	0.5
Deaths outside the hospital—				
Gastric	1	7	8	
	9	14	23	

The mortality was therefore relatively much higher among the males than the females, being 30 per cent. in the former instance and only 9 per cent. in the latter. When one consults the literature on this point but little satisfaction is obtained. The difference is so striking, however, as to suggest a distinct variety of the disease in the two sexes. This view is enhanced by the fact that the age incidence in males is about ten years later than in females, and that hemorrhage is fourteen times as fatal in the men as in the women.

When we compare our mortality of 8 per cent. with that of Leube's of 2 per cent. it leads to deep reflections. There is no question but that

[1] This was a case of ulcus carcinomatosus. The patient's first hemorrhage occurred in June, 1893, and he entered the hospital for the first time on March 27, 1894. He returned August 23, 1894, and again later on, August 6th and October 25, 1895, when he finally died, and the autopsy showed that a cancer had developed about an old ulcer.

the hospital dealt with a severer type of the disease, as its percentage of hemorrhage cases was 81 to his 46; yet even with this allowance, and leaving out the death by exploratory laparotomy, that by nephritis, and that by cancer, the mortality remains nearly twice as great. The more closely to bring out these differences we put the main features side by side:

	Leube.	*Mass. Gen. Hospital.*
Mortality	2.0 per cent.	8.0 per cent.
Hemorrhage	0.8 "	3.7 "
Perforation	1.2 "	2.7 "

Eighty per cent. of the patients were considered cured or relieved at the time of their discharge, but our later information shows that relief continued in but forty-six instances, or 40 per cent. Of ninety-nine patients who left the hospital we know that eight subsequently died[1] of gastric trouble, and that forty-one had a recurrence of ulcer symptoms. A recurrence, then, took place in one-half of the cases. Twelve of this number, however, reported themselves well at the time of writing. Statistics on this point are not easily obtainable, and hence their significance. They point to the seriousness of an ulcer of the stomach, and if this paper does no more than to impress this fact more strongly on the profession we shall feel rewarded for our labor. It certainly is startling to realize that every other patient with gastric ulcer that one sees in the hospital is either to have a recurrence of symptoms or is never to be well again.

We had hoped to be able to estimate the number of cases which resulted in cancer and in dilatation, but the reports received are not specific enough to warrant us in drawing deductions of this nature. Ewald[2] is certainly right when he says: " Ich habe mit den Jahren diese Narbenbildungen fast noch mehr wie das primäre Ulcus fürchten gelernt."

Treatment. The results of treatment show that the percentage of recovery in both medical services of the hospital was the same. In one service it was the general rule to stop all food by the mouth for the first few days after entrance. On the other, this treatment was resorted to only in the severer cases, the diet being more often restricted to a small quantity of milk and lime-water for a corresponding number of days, and later on increased. The figures regarding the treatment are here given:

	Service A.	*Service B.*	*Total.*
Number of cases with no food by mouth	71	31	102
Number of cases with food by mouth	23	60	83
Doubtful	2	0	2

The average duration of the period in which the patients received food by nutrient enemata was 8.39 days, the longest period being thirty-

[1] Seven other patients died after leaving the hospital; in three of these the cause of death was known to be other than gastric; in four it was in doubt.

[2] Ewald. Loc. cit., p. 407.

six days and the shortest one day. We then studied these two classes of cases with reference to their condition since leaving the hospital, and thereby found the following result:

	No food by the mouth.		*With food by the mouth.*	
Cured	20	32 per cent	23	44 per cent.
Not cured	42	68 "	29	56 "
	62		52	

From these tables it would appear that only 32 per cent. of those receiving food by the mouth were cured, in contrast to 44 per cent. of cures in those patients who were given small quantities of milk and lime-water from the outset; but one must bear in mind that it was chiefly the severe cases which were put on nutrient enemata alone, and that this fact directly tended to make a less favorable showing for the starvation method. Another fact is, furthermore, of interest—namely, that the patients who were starved remained a longer time in the hospital on the average than those who were fed small amounts of milk and lime-water. Evidently it took longer for the former class of patients to get built up, and this was natural, for their condition was worse at entrance.

Conclusions based on the study of 187 cases of gastric ulcer occurring at the Massachusetts General Hospital, 1888–1898:

1. Gastric ulcer is more frequent in Boston than in Chicago, Baltimore, Denver, or San Francisco.

2. It is five times as common in women as in men.

3. The average age in men is thirty-seven years; in women twenty-seven.

4. Hemorrhage was present in 81 per cent. of the cases. It caused the death of 17 per cent. of the male patients, but only 1.27 per cent. of the females. No woman under thirty died of hemorrhage from gastric ulcer during this period.

5. The blood was that of a chlorotic type of anæmia.

6. Perforation occurred in 3.2 per cent. of the cases, and none of these patients left the hospital alive.

7. Of 114 patients 80 per cent. were discharged cured or relieved, but at the end of an average period of five years only 40 per cent. remained well. The mortality at the same time (due to gastric disease) was 20 per cent. Among the males it was 30 per cent., with the females 9 per cent.

8. The excessive mortality of ulcer among men, its occurrence in life a decade later than in women, and the absence of fatal cases of hemorrhage in females, point to a difference of the ulcer in the two sexes.

9. The mortality of 8 per cent., and the failure of medical treatment to effect a lasting cure in 60 per cent., of the patients indicates the need of surgical intervention in other than emergency cases of this disease.

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